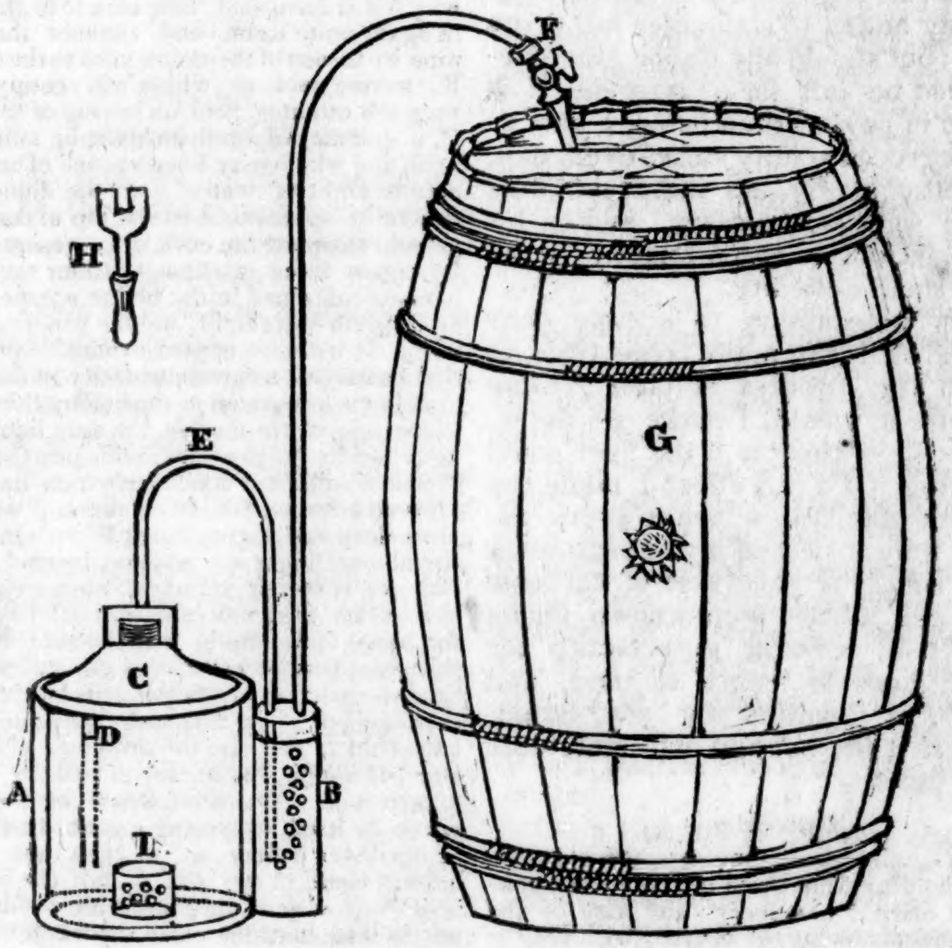
AMERICAN
MECHANICS' MAGAZINE,
Museum, Register, Journal and Gazette.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

VOL. I.—No. 11.] SATURDAY, APRIL 16, 1825. [Price $4 PER ANN.

"Dim as the borrowed beams of moon and stars,
To lonely, wandering, weary travellers,
Is Reason to the soul. And as on high
Those rolling fires discover but the sky,
Nor light us here; so Reason's glimmering ray
Was sent not to assure our doubtful way,
But guide us upward to a better day." *Dryden.*

## APPARATUS FOR PREVENTING FERMENTED LIQUORS FROM PASSING INTO THE ACETOUS OR SOUR STAGE.




SIR,—I send you a drawing, together with a description explanatory of a little instrument, which I last summer found of considerable utility in a domestic point of view, and which may be equally so to that part of your readers who either brew themselves, or have occasion to keep in tap malt or other fermented liquors. It is a well known fact, although not always the more agreeable on that account, that cider, perry, and even ale and porter, leaving out of the question that undefinable compound, London small or table beer, very soon become, if in cask and in tap, extremely flat and insiped; this state continuing until another change takes place, viz. the production of acidity, or transformation, partially or wholly, into vinegar.

To remedy this evil mechanical

means have been resorted to, and patent cocks and vent-pegs introduced without number. These, however, only guard against the carelessness of servants, and are otherwise quite incompetent to the task, inasmuch as some body, either fluid or aëriform, must be admitted above to allow of the liquor escaping from the cock below. When, however, the fluid has become hard, or, in another word, sour, chemical means are called in; and if they cannot bring back the spiritous out of the acetous stage, they can at any rate prevent the injurious action consequent upon the internal reception of a fluid in such a state. To this effect, a few grains of the finely powdered bicarbonate of soda are generally added to a tumbler full of the beer; but should any liquor thus carbonated be left for a moment, it is worse in flavour than before; and as the degree of acidity varies every day, so, consequently, an increased dose of the soda is necessary, and to hit the point of saturation exactly is one of no small difficulty.

It is unnecessary to occupy your pages with the many objections to which this process is liable; those who use it would, I make no doubt, rather be without it if the beer could be saved. To this effect I made the present machine, which in every respect fully answered my expectations. It is simply a generator of carbonic acid gas, a body well known for its quality of resisting putrefaction for a considerable length of time, and which, if absorbed by any liquid, renders it brisker and more palatable than before.

*Description*

A is a cylindrical stoneware vessel, capable of holding from three quarts to one gallon, or more if necessary; the size of the instrument varying, of course, with that of the cask in tap, and perfectly open at the top, with the exception of a rim, in which two notches are cut; attached on the one side is a small reservoir, B, for containing a little water, and which may be thought necessary to purify the gas as it is generated; this vessel, which need not be of a greater capacity than a half pint-measure, has no direct communication with the other part of this apparatus. C is another vessel, of a bell shape, quite open at the bottom, and furnished with a dome top, mounted with cap and screw, to which the pipe, E, is affixed. D is one of two small projections, which serve to keep the bell down and steady it in its place. F is an union joint, which connects the long pipe to the screw, which is first made fast in the vent-hole of the cask, by turning with the key, H. I is a basin or vessel perforated at the bottom, and which is used to hold the marble or chalk for generating the gas. To set this apparatus at work, first make the screw tight into the cask, G, which may either rest on its side, or be placed on one end, as in the drawing; the latter I consider preferable; the capillary attraction between the fluid and the fibres of the wood not being in this way impeded, and a small quantity of water poured on the top or head of the cask being sufficient to keep all tight Secondly, remove the bell from the outer case, and put such a quantity of common marble, carbonate of lime broken into fragments, about the size of a walnut, into the dish, I, as will two-thirds fill it; put the bell in its proper position, as represented; make the flexible tubing, E, fast; half fill the reservoir, B, with water, by one of the three apertures or necks with which it is furnished; take care to fit the cork in again quite tight, and connect the long pipe by means of the union joint to the screw, F; having done so, which will occupy but a very few minutes, pour on the top of the bell, C, a quantity of dilute muriatic or sulphuric acid, and which may be composed of one part acid to eight of water, until the liquor just makes its appearance at the top of the outer vessel; take out the cork in the reservoir, B, for two or three minutes, to suffer the common air contained in the bell to escape; fasten it again quite tight, and the process is finished. It will now appear evident to any one, that as soon as a certain quantity of carbonic acid gas is generated in the bell by the action of the acid on the marble, the acid liquor will be driven by the pressure inside into the outer vessel, a sufficient space for which has been allowed between the two; there it will remain until the stop-cock at F, to which the thumb and finger are applied, instead of the common vent-peg, is turned, when a quantity of fixed air will rush into the cock to supply the place of the liquor withdrawn. Should this stop-cock be left turned on, an absorption of a portion of the gas will be the only consequence; and this, as before stated, will only tend to increase the briskness of the liquor, although, in general, it will be better to turn it off. The diluted acid having now got to its level, supposing a quantity of beer, or whatever it may be, to have been withdrawn, equal to the size of half the bell, it is actively at work on the marble within, and would thus continue until the whole of this substance, or the acid, were expended, or, as will here be the case, until the pressure produced again forces it between the two vessels. When this gas is used, another portion is made, and so on, until either the cask is emptied of its contents, or the acid neutralized. Should the latter be the case, the addition of a little more strong acid will produce an extrication of a fresh portion of the gas, provided there still remains some undecomposed carbonate of lime; but if this is not the case, the bell must be raised out of the larger vessel, and the basin, I, replenished as before.

As I now fear that I have obtruded too

much upon your time and space, I shall only add, that the expense of the gas, as generated by this machine, will not, for a butt, be more than equal to half a gallon of the same liquid of ale, and that it will preserve the whole to any moderate length of time from the injury which must always attend the admission of common air; and that even the expense of the machine itself will not be proportionate to the loss occasioned in the common way.

I shall take the opportunity, in a future Number, of giving a practical hint or two on a ready method of preventing liquors and home-made wines, especially while in a state of fermentation, from passing so suddenly into the acetous stage, and to which, in warm weather, they are so very liable.

Until then, I remain, Sir,

Your obedient servant,

F. JOYCE.

11, Old Compton-street, Soho.

---

## RILWAYS.

(*Continued from No.* 10.)

In our last we gave a brief account of the nature and construction of Railways. We now pursue our inquiry into the effects of a determinate force of traction employed on railways and canals.

In calculations respecting the power of a horse exerted in different modes, errors often arise from considering this power as a constant quantity, which it is not. At a *dead pull* an ordinary horse exerts a force of traction equal to 150 pounds; this is reduced to less than one-half when he travels four miles an hour; to to one-ninth part when he travels eight miles an hour; and at twelve miles an hour his whole strength is expended in carrying forward his own body, and his power of traction ceases. It is supposed here that the horse performs pretty long journeys. When travelling very short stages, he may exert a force considerably greater; and his power of traction may perhaps cease only at a velocity of 15 or 16 miles an hour. But in common cases a velocity of 12 miles may be taken as the maximum; and, for the convenience of calculation, the dead pull may be taken at 144 pounds. Adopting, then, Professor Leslie's rule, the force of traction at any degree of velocity ($v$) will be $=(12-v_2.)$ Thus, the force exerted, at two miles an hour, will be 1000 pounds; at four miles, 64 pounds; at six miles, 36 pounds; at eight miles, 16 pounds; and at ten miles, only 4 pounds. Steam-engine makers assume a horse-power to be equal to a weight of 180 or 200 pounds, but this is to be considered merely as an arbitary and conventional standard, adopted for a particular purpose. It is necessary to keep this general conclusion in view, when we speak of the application of horse-power to the traction of loaded wagons and vessels.

The resistance to the motion of a vessel in the sea or a canal, is of an extremely different kind from that which a carriage of any kind experiences upon a common road or a railway. In the former case it arises from the pressure of the water on the bow and sides of the vessel; in the latter, from the friction of the axle in its box, and that of the rim of the wheel on the gravel or iron rail. The motion of the body in both cases is resisted also by the air; but this resistance, which is small in amount, generally speaking, we shall throw entirely out of view in the first instance, in order to simplify our calculations.

On a well-made road a horse will draw a load of one ton, in a cart weighing 7 cwt., at the rate of two miles an hour. (Leslie's Elements, p. 253.) The whole strength of the horse is exerted in overcoming the friction. On such a road, therefore, a force of traction of 100 pounds moves a weight of 3000 pounds, or the friction is 1-30th part of the load (the cart included.)

On a railway of the best construction, it has been shown in our former paper, that a horse travelling at the same rate of two miles an hour draws 15 tons, including the vehicles In this case, then, a power of traction of 100 pounds moves a weight of 33,600 pounds; the friction of course is 1-336th part, or, in round numbers, 1-300th part of the load.

On a canal, a horse travelling at two miles an hour draws 30 tons in a boat weighing probably 15 tons.*

* Boats in some cases carry only 15 or 20 tons; in others 35 (as the coal boats on the Union Canal;) but in the one case they

Reducing the ton to 2000 pounds, for the sake of round numbers, as in the last calculation, we find here that a power of traction of 100 pounds, moves a mass of 90,000 pounds, or the resistance which the water opposes to the motion of the vessel is equal to 1 900th part of the load or entire weight. At sea, where the waterway is of unlimited breadth, the resistance is probably one-third less; but as a compensation for this, when steam power is employed, there is probably a loss of one third, in consequence of the disadvantageous mode of its application.

We see, then, that the effect produced by the draught of a single horse is ten times as great upon a railway, and thirty times as great upon a canal, as upon a well-made road. Yet a railway costs only about three times as much as a good turnpike road,* and a canal about nine or ten times; and the expense of keeping the railway and canal in repair is probably less in proportion to the original outlay than in the case of a road. It is obvious, then, that were railways to come into general use, two-thirds or more of the expense of transporting commodities would be saved. With regard to the comparative advantages of canals and railways, so far as the present facts go, we may observe, that if a horse power effects three times as much upon a canal as upon a railway, the canal costs about three times as much, and will of course require nearly the same rates or *dues* per ton to make the capital yield the same interest.

But here it is of great importance to recollect, that this computation refers solely to a velocity of *two miles an hour*. If the friction which impedes the motion of a car or wagon, and the resistance which the water offers to the progress of a ship, were governed by the same laws, the same conclusions would hold true, whatever the velocity might be. But this is far from being the case, as we shall presently see. In illustrating this point, it will be convenient, instead of estimating effects by the variable measure of a horse-power, to refer to a determinate and constant force of traction of a given amount. We shall therefore assume, that the body to be moved is urged forward by a force exactly equivalent to a weight of 100 pounds, suspended over a pulley at the end of the plane on which it moves.

First, with regard to the motion of a body in water. It is deduced from the constitution of fluids, and confirmed by experiment, that the resistance which a floating body encounters in its motion through the fluid is as the square of the velocity.† Now, taking as a basis the known effect of a force of traction of 100 pounds at two miles an hour, let us ascertain what force would move the same body at a greater velocity. On a canal, or arm of the sea, we have seen that a body weighing 90,000 pounds is impelled at the rate of two miles an hour by a force of 100 pounds; therefore, to move the same body,

| | | | |
|---|---|---|---|
| At 4 miles an hour, | will require | 400 pounds | |
| At 6 ditto, | ditto, | 900 | do. |
| At 8 ditto, | ditto, | 1600 | do. |
| At 12 ditto, | ditto, | 3600 | do. |

Or conversely,—

| | | | |
|---|---|---|---|
| 100 pounds moves | 90,000 pounds | at 2 | miles an hour, |
| | or 22,500 | at 4 | do. |
| | or 10,000 | at 6 | do. |
| | or 5,620 | at 8 | do. |
| | or 2,500 | at 12 | do. |

travel quicker, and in the others slower, than the rate mentioned.

* In Mr. Telford's estimates for portions of new road between Edinburgh and Wooller, we find the expense to be from 1000l. to 1100l. per mile, including the price of the ground.

† See Playfair's Outline, I. 198; Leslie's Elements, section vii.; article *Resistance* Encycl. Brit.

Hence we see, that when we have to contend with the resistance of water, a great increase of power produces but a small increase of velocity. To make a ship sail *three* times faster, for instance, we employ *nine* times this power; and to make her sail *six* times faster, we must employ no less than *thirty-six* times the power. Let us suppose, for example, that it were required to determine, since one horse draws a boat loaded with 30 tons at two miles an hour, how many horses would draw the same boat at four miles? We find, first that since the boat is to move *two* times as fast, it will requre *four* times the absolute amount of power, or 400 pounds. But a horse moving at four miles an hour pulls only with a force of 64 pounds. Of course, it would require six horses to exert a power of 400 pounds, and move the boat at the rate proposed.

Let us now see what amount of power will produce corresponding effects upon a railway. And before we make more particular inquiry, let us suppose that the retardation occasioned by friction, instead of increasing as the square of the velocity like the resistance of a fluid, increases in the simple ratio of the velocity. We have seen, then, that a force of traction of 100 pounds, upon a level railway, moves a body weighing 30,000 pounds at the rate of two miles an hour. We may hence calculate the effect produced by any greater amount of power:—

| | | | |
|---|---|---|---|
| 30,000 pounds are moved at | 2 miles an hour | by a power of | 100 pounds |
| | at 4 | by | 200 do. |
| | at 6 | by | 300 do. |
| | at 8 | by | 400 do. |
| | at 12 | by | 600 do. |

Or conversely,—

| | | | |
|---|---|---|---|
| A power of 100 pounds moves | 30,000 pounds | at 2 | miles per hour, |
| | or 15,000 do. | at 4 | |
| | or 10,000 do. | at 6 | |
| | or 7,500 do. | at 8 | |
| | or 5,000 do. | at 12 | |

Hence we see, that though a moving force of 100 pounds produces three times as great an effect upon a canal as upon a railway *at two miles an hour*, this superiority of the water conveyance is lost if we adopt a velocity at six miles an hour; and at all greater velocities, the same expenditure of power will produce a greater effect upon a railway than upon a canal, a river, or the sea.

This calculation proceeds on the hypothesis, that the friction increases in the simple ratio of the velocity. Such was the opinion of Ferguson, Muschenbroeck, and some other writers; but the more recent and accurate experiments of Coulomb and Vince have overthrown this doctrine, and established conclusions extremely different, of which the following is an abstract*:—

1. The friction of iron sliding on iron is 28 per cent. of weight, but is reduced to 25 per cent. after the body is in motion.

2. Friction increases in a ratio nearly the same with that of the pressure. If we increase the load of a sledge or carriage four times, the friction will be nearly, but not quite, four times greater.

3. Friction is nearly the same whether the body moves upon a small or a greater surface; but it is rather less when the surface is small.

4. The friction of rolling and sliding bodies follows nearly, but not precisely, the same law as to velocity; and that law is, that *the friction is the same for all velocities*.

It is with this last law only that we have to do at present; and it is

* Leslie's Elements, p. 188, &c.; Playfair's Outlines, I. 88, &c.; Journal de Physique, 1785; Philosophical Transactions, 1785. Dr. Brewster has given the results of Coulomb's experiments in a tabular form, in the article *Mechanics*, in his Encyclopædia.

remarkable, that the extraordinary results to which it leads have been, so far as we know, entirely overlooked by writers on roads and railways. These results, indeed, have an appearance so paradoxical, that they will shock the faith of practical men, though the principle from which they flow is admitted without question by all scientific mechanicians.

First, It follows from this law, that (abstracting the resistance of the air) if a car were set in motion on a level railway, with a constant force greater in any degree than is required to overcome its friction, *the car would proceed with a motion continually accelerated, like a falling body acted upon by the force of gravitation*; and however small the original velocity might be, it would in time increase beyond any assignable limit. It is only the resistance of the air (increasing as the *square* of the velocity) that prevents this indefinite acceleration, and ultimately renders the motion uniform.

Secondly, Setting aside, again, the resistance of the air (the effects of which we shall estimate by-and-bye,) *the very same amount of constant force which impels a car on a railway at two miles an hour, would impel it at* 10 *or* 20 *miles an hour*, if an extra force were employed at first to overcome the *inertia* of the car, and generate the required velocity. Startling as this proposition may appear, it is an indisputable and necessary consequence of the laws of friction. In fact, assuming that the resistance of the air were withdrawn, if we suppose a horizontal railway made round the globe, and the machine (supplied with a power exactly equivalent to the friction) to be placed on the railway, and launched by an impulse with any determinate velocity, it would revolve for ever with the velocity so imparted, and be in truth a sort of secondary planet to our globe.

Now, it would be at all times easy (as we shall afterwards show) to convert this accelerated motion into a uniform motion of any determinate velocity; and, from the nature of the resistance, a high velocity would cost almost as little, and be as easily obtained as a low one. For all velocities, therefore, above four or five miles an hour, railways would afford facilities for communication prodigiously superior to canals or arms of the sea. Indeed, there is scarcely any limit to the rapidity of movement these iron pathways will enable us to command; and we cannot give a better idea of the astonishing power they put in our hands, than by referring to the remark of Dr. Young, quoted in our last. What he states is strictly true, that the resistance of the air, which, with the velocities and powers of traction we now commonly employ, is an element that may be entirely neglected, would then become the principal retarding force. We need scarcely add, that the question of time or velocity, rightly considered, involves every thing connected with the mercantile advantage of different modes of communication.

We have here considered the subject in a purely theoretical light, leaving it to the engineer to find the means of giving effect to the truths we have stated. We shall enter into various details in a future paper, and touch upon some points of a practical nature. In the mean time we think it right to say, that the conclusions we have announced are strictly conformable to experiments carefully made by Vince and Coulomb; but as there are anomalies in the doctrines regarding friction, and as the velocities employed in the experiments alluded to were much lower than some that are likely to occur in railway communications, we do not take upon us to guarantee the literal accuracy of the principles laid down as applicable to every possible velocity. We certainly believe that the conclusions founded upon in our culations will hold true at all velocities whatever, and they are stated, without limitation, by the most profound mechanicians, Leslie, Playfair, Young, &c.; but we thought it right to mention a circumstance which some may consider as materially affecting their universal application.

*(To be continued.)*

# OIL AND COAL GAS.

Sir,—Knowing the object of your Magazine to be the diffusion of useful information, commercial as well as *mechanical*, I have taken the liberty to send you the following practical observations on Oil and Coal Gas. Having had considerable experience in coal, and, for some time past, in oil gas, I have been at some pains to ascertain their relative cost, proportion of light, and consumptive difference; and judging that an investigation of this nature, and particularly a practical one, would be acceptable to some of your readers (especially those persons who are contemplating the introduction of gas into their establishments,) I have, for their information, transmitted this account. It must be observed, however, that the rates here used are Manchester rates; of course, this calculation of difference in cost will not be correct where fuel is dearer, yet, by taking into the account all local differences, a true statement may readily be made.

| OIL GAS. | COAL GAS. |
| --- | --- |
| One gallon of good whale oil will make nearly 77 cubical feet of gas; this, at the rate of 2*s*. 3*d*. per gallon, is 29*s*. 2*d*. for 1000 feet. | One pound of Wigan kennel coal will make, at the lowest calculation, three feet and a half of gas; this, at the rate of 10*d*. for 112 pounds, is 2*s*. 1½*d*. for 1000 feet. |
| Imparts very little heat; is on this account preferred by some. | Emits considerable heat, so much so, that where much gas is used and much heat wanted, the saving is great. |
| Is exceedingly weak, and liable to be extinguished by agitation; persons passing hastily, the closing of a book or motion of machinery, will effect this, if not enclosed in a glass chimney. | Not subject to this inconvenient defect—a dangerous one too, as re-lighting is attended with cosiderable risk. |
| For every 1000 feet of gas evaporated, 10 lbs. of coke is used for volatilizing, and 80 lbs. of coal for heating the retorts. | For every 1000 feet of gas made, 20 lbs. of coke are gained over and above what is wanted for heating the retorts. None but the best Wigan kennel coal will produce this quantity, and it is necessary that the retorts should be semi-elliptical, and set up on the oven plan, as most gas may be obtained with the least fuel by this means. |
| Holds in solution a considerable quantity of essential oil, which chokes up the horizontal jet frequenly. | Not subject to this inconvenience. |
| Emits considerable quantities of lamp-black, which horizontal jets cannot consume; the Oil Gas Companies therefore recommend vertical jets (a great disadvantage, as the horizontal lights give so much more light downwards) and glass chimneys, for the purpose of consuming the lamp-black, and preventing the apertures being clogged with the oil. | Is not so subject to smoke or choking up of the burners. |

| OIL GAS. | COAL GAS. |
|---|---|
| Light irregular, varying from 2.5 down to 1.5 compared with coal-gas. | Light regular and strong. |
| Free from sulphuretted hydrogen. | May be freed from sulphuretted hydrogen by washing in sulphuretted acid. |

I have stated, in this comparison, that only three and a half feet of gas are made from one pound of kennel coal; but our last average for the winter season was three and three quarters feet from one pound of kennel; however, three and a half feet was the average before the retorts were set up on the oven plan, and with Mr. Worthington's exhausting apparatus, which draws off the gas to prevent decomposition in the retorts (a very ingenious and self-acting machine,) they produce from five to five and a half feet of gas from one pound of kennel coal. A number of these are now at work in this neighbourhood, and may be seen at the following places:—

Messrs. Burton, Middleton.
Tod and Hough, Newton Heath.
Roe and Duncalf, Hollinwood.
Mosely and Howard, Disley, &c.

From the above results it appears (allowing the consumption of oil compared with coal-gas as 1.5 to 1, which is the utmost, and one gallon of oil to produce 77 feet, and one pound of kennel coal three and a half feet of gas) the same proportion of light may be obtained from each at the following rate:—oil-gas, 29*s.* 2*d.* coal-gas, 6*s.* 9*d.*

In making this calculation I have not taken advantage of the quantity of gas made by Mr. Worthington's apparatus, nor of the saving in generating the gas, as mentioned above, in coal and coke; in this case the comparison will be as 29*s*, 2*d.* to 4*s.* 2*d.* or 7 to 1.

The advantages which oil possesses over coal gas are these—the generating apparatus and gas-holder occupy but two-thirds of the space, and may be laid down at two thirds of the cost of coal gas; oil gas is free from sulphuretted hydrogen, and makes less residuum. though that is cosiderably more than is represented by the advocates for oil gas; as for the mephitic odour, there is little difference

I am, Sir,
Your obedient servant,
R.

Manchester.

### REPORT OF THE ROYAL DUBLIN SOCIETY IN FAVOUR OF OIL GAS.

At a meeting of the Royal Dublin Society, on the 9th of December last, Mr. Flood presented the following Report from the Committee appointed to examine into the expediency of introducing Gas Light into the different apartments of the Royal Dublin Society:

"Your Committee have to report, that proposals have been laid before them from the Hibernian Coal Gas Light Company, offering to supply coal gas, per metre, at one shilling and sixpence per hundred cubic feet.

"That proposals have also been laid before them from the Dublin Oil Gas Light Company, offering to supply oil gas, per metre, at five shillings British per hundred cubic feet.

"That your Committee have consulted some of the most eminent scientific writers who have published their opinions on the different gases, and find that the illuminating power of oil gas, in comparison with coal gas, is at the lowest ratio, as 1 to 3 1-2 *i. e.* that one cubic foot of oil gas will give as much light, and will burn as long, as three and one-half feet of coal gas. That the oil gas does not injure metallic substances, furniture, paintings, gildings, or such like, and your Committee are decidedly of opinion that oil gas alone ought to be introduced into these premises.

"Your Committee, therefore, recommend that oil gas lights be forthwith fitted upon the plan and in number as follows," viz.—(Here follows an enumeration of lights, &c.)

### ON THE COMPARATIVE VALUE OF OIL AND COAL GAS.

(*Continued from No.* 10.)

THE ILLUMINATING POWER OF OIL AND COAL GAS has been differently stated by different persons. According to some, the power of the oil gas is as three and a half, the coal

gas being one, while according to others, it is only two, and even not greater. On this question, however, turns one which is of very great importance, whether oil or coal gas works are most advantageous; and we must, therefore, follow Dr. Fyfe more closely in this part of his work. He first throws doubts on some experiments of Mr. Ricardo's, and of other gentlemen, on account of their having been incorrectly made, while he seems disposed to admit the accuracy of the exeriments of Messrs. Herapath and Rootsey which do not give so high an illuminating power to oil gas. Mr. Dewey's experiments published in the Annals of Philosophy, last December, and which showed a great degree of illuminating power in oil gas, were made, it appears, as well as some other experiments, with coal gas with very small specific gravity, only 406; and Dr. Fyfe contends, that the illuminating power of both gases, after being properly purified, is in proportion to their specific gravity. The oil gas Mr. Dewey used was 939, which is very good; and if (says Dr. Fyfe) a good oil gas is only three and a half times superior to a very inferior coal gas, its superiority must be much reduced when brought into competition with the latter, when of an equally good quality. Dr. Henry proposed to ascertain the illuminating power of each gas by the quantity of oxygen necessary for its combustion, and, tried by this test, he obtained the following results:—

One hundred volumes of coal gas, of the

| Specific Gravity, | Took of Oxygen, |
|---|---|
| 345 | 78 |
| 500 | 166 |
| 620 | 194 |
| 630 | 196 |
| 650 | 274 |

One hundred volumes of oil gas, of the

| Specific Gravity, | Took of Oxygen, |
|---|---|
| 464 | 116 |
| 590 | 178 |
| 758 | 220 |
| 906 | 260 |

From this it appears, that the best oil gas is to the worst coal gas as three and a half to one, while the best of both stand in the relation to another of 26 to 21. On the theory, that the olefiant gas contained in both is the principal source of light, as this may be condensed by chlorine, Dr Fyfe proposes this as a test of the illuminating power of each. The mixture must be excluded from light to prevent any action on the carburetted hydrogen. Dr. Fyfe recommends the following method for trying this experiment:—A graduated jar, inverted in a water trough, must be filled to 50 with the gas; 50 measures of chlorine must then be introduced, the tube being covered with a paper shade, to prevent any action on the other gases. In the course of form 10 to 15 minutes the condensation is complete; and as chlorine and olefiant gases combine in equal proportions, the diminution in the mixture indicates correctly the quantity of olefiant gas in the gas subjected to trial This, Dr. Fyfe says, promises to be an accurate mode of ascertaining the comparative illuminating powers; and by this method he has found the oil gas prepared in Edinburgh to be to the coal gas 31 to 17, or nearly 1.8 to 1. Dr Fyfe, we see, admits that the other constituents of both gases possess some illuminating powers; and unless the proportion of these other ingredients were the same in both, we cannot see how his method can be any thing more than an approximation to accuracy. He concludes this part of the subject, however, by stating, "I suspect coal gas will be found to possess, or at least may be made in general to possess, about half the illuminating power of that from oil." He has found this to be the case with those made in Edinburgh, by producing the same quantity of light and marking the quantity of gas consumed.

He then enters into some calculations to show the cost of manufacturing oil and coal gas; but this depends on so many circumstances, that we cannot follow him. Having stated his opinion as to the quantity of light to be obtained from the two gases, we must leave it to the discretion of our readers to choose either, as they are so placed to obtain the material

at a dear or cheap rate. But though Dr. Fyfe thinks that, at present, oil gas cannot be made so advantage ously as coal gas, he does not assert that it never can. "Oil gas establishments," he says. "are in their infancy; and as, by the present mode of decomposing oil, there is a considerable loss of illuminating power, other and more effectual methods of decomposing it may be discovered, which will allow it to be offered at a cheaper rate, and thus bring it into competition with coal gas, provided we consider it as having three times the illuminating power; but if, as I have endeavoured to show, it is only about twice that of coal gas, I fear it never can come into competition with it."

## TO DECOMPOSE WATER BY GALVANIC ELECTRICITY.

(*From the Chemist.*)

To effect this it is quite necessary that your correspondent should provide himself with a galvanic battery, or he may make a voltaic pile. The wires should be of platina, as with other metals all the oxygen of the water will combine with the wire, and the hydrogen gas alone be disengaged. To merely effect the decomposition without procuring the products separately, a glass tube must be procured, and after being nearly filled with water, must be corked up at both ends. The two wires from the opposite ends of the battery must then be thrust through the corks, and brought pretty nearly into contract. Immediately they come into this position, bubbles of air will be emitted from each wire. By the decomposition of the water, the oxygen gas is evolved at the positive, and hydrogen at the negative pole of the battery. It is not likely, however that your correspondent will be satisfied, Mr. Editor, unless he collects the two gases in separate vessels. For this purpose he must provide himself with two glass tubes, open at one end and corked up at the other. He must fill them with water, and place them inverted in a glass vessel, and must then pass the wires, from the battery through the upper ends of each tube and bring them nearly into contact at the bottom of the glass. The instant this is done, oxygen is disengaged at the end of one wire, and hydrogen at the other, and each rises in its own separate tube; and they are always found to be in proportion of two measures of hydrogen to one of oxygen. Before your correspondent makes this experiment, he should distil the water, to have it pure, or at least boil it, to separate the air and carbonic acid gas.

I am, Sir,
Your obedient servant,
T. Z.

*Milk street, Cheapside,* *Aug.* 2.

## HOUSE ROOFS.

SIR,—I take the liberty of calling your attention to a subject of great importance to the inhabitants of all large cities—the Roofing of Houses. In the East all houses have flat roofs, which are covered with a sort of composition much resembling Roman cement. These roofs are perfectly impervious to water, and form a pleasant terrace, on which the inhabitants can sit and enjoy the evening air in fine weather. It has always appeared to me that the introduction of this plan of roofing would be a great improvement in our European cities.

In the first place, it would afford a pleasant terrace during fine weather.

2d,—It would much improve the appearance of a street of houses; for what can be more ugly than large sloping roofs which expose to view all the unsightly stacks of chimnies?

3d.—It would be a great means of checking the progress of fires: for it is chiefly by means of the present roofs that fires spread with such fatal rapidity; the rafters, slating-boards, &c being almost as combustible as a stack of faggots. The expense would not be greater, for although the timber of a flat roof requires to be stronger, the diminution of their numbers would compensate for the additional strength and cost.

I shall be obliged if you will call the attention of practical men to this subject. I am, Sir,

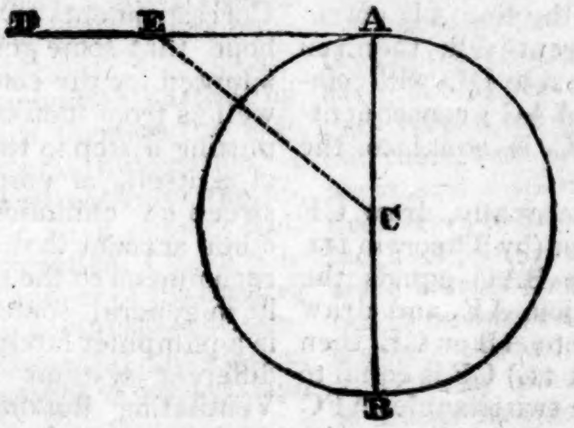
Your obedient servant,
A TRAVELLER.

# MECHANICAL GEOMETRY.

*(Continued from our last Number.)*

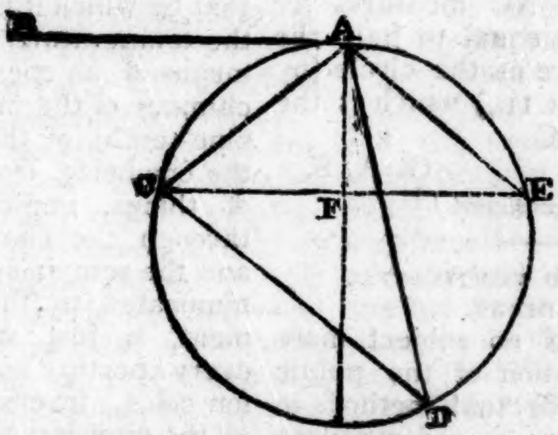
### THEOREM V.

**If, from the extremity of any diameter of a circle, we, draw a line perpendicular to it, it will be a tangent to the circle in the point the diameter meets it.**




If, from the extremity A of the iameter AB. we draw AD perpenicular to AB, it will be a tangent to e circle, or touch it in the point A ithout cutting it, according to Dention 10, Part II.

From the centre, C, draw any ther line, as CE, to meet AD; now e triangle AEC has, by its conruction, the angle at A a right gle, or 90 degress; the angles at and E will be each less than a ght one; now, as the angle at A is the greatest angle, the side BC is always longer than AE or AC (by the Corollary to Theorem VI. Part I.;) hence, however near we make the point E to A, EC will always be greater than AC, which is the radius of the circle, and hence the point E will always be without the circle, and cannot coincide with it but in the point A; therefore the line DEA is a tangent to the circle, and only meets it in one point at A, but does not cut it.




### THEOREM VI.

**The angle formed by a tangent d a chord drawn from the same nt in a circle is equal to the angle the circumference of the opposite segment, that is, it is equal to the angle formed by two chords drawn from the extremities of this chord, to meet in the circle on the opposite side to the angle formed by the chord and tangent.**

Let AB be a tangent to the point A, and AC any chord drawn from the same point, now, if we draw any two chords, as AD and CD, from A and C to meet in D, the angle BAC will be always equal to the angle ADC.

Having drawn the figure, as in the preceding page, cut out the triangle ACD, and apply the angle D to the point A, and let the line AD correspond to the tangent AB, then you will find that the side DC will coincide with the chord AC; consequently the angle BAC is equal to the angle ADC.

Or, more geometrically, draw CE parallel to AB, then (by Theorem III. Part I.) the angle BAC equals the angle ACE; now join AE, and draw AF perpendicular to AB or CE then (by Theo. IV Part II.) CF is equal to FE, and hence the two triangles AFC and AFE are *indentical*, that is, the side CF equals FE, and the side AF common to both triangles, and the angles AFC and AFE both right angles; hence the angles ACF and AEF are equal, but ACF is equal to BBC; consequently AEC, or its equal ADC (by Theorem I Part II) will also be equal to the angle BAC: which was to be shown.

COROLLARY I.—Hence the angle any chord and tagent make with each other is equal to half the arc that chord subtends, that is, the angle BAC is equal to half the number of degrees the arc AC measures for the angle CDA is equal to half the angle at the centre of the circle (by Theorem II. Part II.,) which is the measure of arc AC.

G. A. S.

*(To be continued.)*

## WARMING AND VENTILATING BUILDINGS.

SIR.—There is no subject more worthy the attention of the public than the very ineffectual methods in common use to warm and ventilate our apartments, and the very common complaint of smoky rooms, and draughts produced from the wrong position of doors and windows, which subject us to the alternative of being stifled by the one, or chilled by the other. Indeed I have been often surprised that, among all our modern improvements in buildings, so little has been done with regard to the inconveniences felt under the present system; many methods have, indeed, been proposed for warming our work-shops and manufactories, but few of general application to domestic purposes. I am, therefore, induced to call the attention of your numerous Correspondents to the subject, in the hope that some general plan may be adopted for the comfort of us all, as well as from motives of humanity, in putting a stop to that system, so cruel in itself, of employing children to sweep our chimnies. If it was on no other account than this last, I would recommend to the perusal of the public in general, some plans laid down in a pamphlet lately published, on the different systems of Warming and Ventilating Buildings, addressed to the economist, the invalid, the desirer of safety, and the lover of comfort, by G. P Boyce. An extract or two from this production may not be uninteresting; indeed the whole is written in a style that at once commands our attention and convinces us by its reasoning. At page 11, the author observes—"That the present mode of obtaining warmth is defective in an eminent degree, every one however unwilling to confess himself in error, must be innately conscious a more bungling and inefficient process was, perhaps, never devised, than that by which it is attempted to raise the temperature of an apartment by means of an open fire in a grate and chimney of the modern construction; nine-tenths of the heat produced by the one being, from the very nature of things, immediately carried off through the channel of the other; and the remainiug tenth, slowly communicated to the air of the apartment, is just sufficient to convert every aperture and crevice into a trap for colds, fevers, rheumatism, and all the disorders arising from a checked perspiration"

Again, speaking of combustion and the necessity of a supply of oxygen to maintain it, he says—"The fire of combustion in the grate is continually drawing to itself fresh supplies of atmospheric air, and consequently the

radiation of heat in those directions is completely checked and overcome by the superior force of the cold current which as fast as the supply undergoes the calorific process, becomes rarefied, ascends, and is wasted through the above channel of the chimney."

The remarks of the author on the disfiguration of our buildings by the the pile of chimneys, always visible, are worthy the attention of the builder and architect.

I shall now conclude this article by remarking, that, if through the medium of your useful publication, I should draw the attention of the ingenious mechanic to a subject well worthy his consideration, I have only done that which a lover of his country should strive to accomplish—the general diffusion of useful knowledge, and the improvement of our arts and manufactures.

I remain Sir,
Your obedient servant,
G. A. S.

—

We have looked into Mr. Boyce's pamphlet, and concur entirely with our intelligent Correspondent in the praise which he bestows upon it. It is very sensibly and ably written, and we are tempted to add to the preceding extracts the remarks to which G. A S. alludes, on the effect of piles of chimneys in disfiguring our buildings; they contain some well-pointed satire.

"The want of artificial warmth must have been early felt by man, and the art of procuring it may, perhaps, claim an antiquity beyond the age of architecture. The half-clad savage of the colder regions, employed all day in the chase, found, at night, the blazing fire necessary to his very existence; and it was to protect this preserver from the vicissitudes and inclemency of a northern sky, that, at a future period, he surrounded it with walls and a roof, and thus became an architect. When the smoke in this confined situation began to produce him annoyance, a central opening in the roof afforded slow egress to the cause of his discomfiture; and his easily satisfied imagination deemed itself to have now reached the summit of domestic enjoyment. Such were the habitations of our forefathers for many succeeding ages; and erections of this primitive structure may even yet be found in the wilds of America, among the mountains of the North, and in the bogs and fens of a sister country. But as luxury and civilization arose, and buildings began to assume more durable and complicated forms, other modes for the supply of warmth became necessary, and other contrivances to that end were to be introduced. Throughout these changes, the due arrangement and disposition of the several fires seem to have been the stumbling block of our early architects. With some fearful ideas of the consequences to be apprehended from confined smoke, the wide-spreading arches and massy piles they constructed to facilitate its escape, appear, in many instances, to have occupied half the space, and to have cost nearly half the expense of the entire building. Some enormous specimens of this period yet remain, presenting the appearance more of immense natural chasms than of chimneys, frequently exciting the surprise of the antiquary by their unaccountable proportions. The quantity of heat and of unconsumed materials daily wasted through these preposterous cavities, would madden a modern economist; but when lands were to be cleared and forests hewn down, an arrangement which so admirably assisted these ends, by its extraordinary consumption of fuel, could not easily be dispensed with. As woods disappeared, and the means of supporting this waste became more expensive, it was found necessary to contract these vast recesses and erections; so that, after a long contention, the arch of the fire-place no longer vied in magnitude with that of the great church door. In this state the practice has descended to modern times. One slight approximation to a better principle the last century certainly introduced; as from an attention to the laws which regulate the motion of fluids, it was then discovered that a small chimney, by means of its quicker draught, carried off the smoke

quite as effectually as by the sluggish motion in a large one. But the original principle, with all its overwhelming errors, remained unaltered: this quicker draught carried off with it still greater quantities of unconsumed fuel the beneficial effect of the fire was still circumscribed to a space of a few feet from the grate, and the air necessary to support combustion continued to be drawn into the apartment from the external atmosphere, consequently at such a temperature as completely to neutralize what portion had already received the calorific influence."*

### DRY ROT.

Sir,—Your Correspondent who signs "A Ship-Owner," recommends *salt* as a remedy for the Dry Rot. I was an apprentice in the dock-yard at this port, when a famous dry rot doctor of the day, a Mr Jackson, pretended to make our ships last for ever, by putting salt of different kinds, in holes bored into their timbers; but it was found to make the ships damp, destroyed the iron, and injured the health of the seamen; besides, it was considered that the ships decayed faster from being so treated. I worked herewhen a boy, in the year 1772, on the Princess Royal, of 90 guns, that was pickled in this way, I find all the facts stated in detail in an excellent book "On Preserving the Navy," by a Mr. Knowles.

As to Mr. John Burridge's opinion of winter-felled timber, "it is as old as the hills." For my part, I have seen a great deal of timber, and have watched its duration, and believe, if it is of a good quality and well-seasoned before it is used, it signifies but little at what time of the year it is felled. I have seen very good summer-felled timber and very bad winter-felled timber, and the contrary; but I am firmly of opinion that it is a very bad plan to strip the timber before it is felled: some so treated now in this dock-yard, proves this.

As Mr. J. Burridge was born and bred in this town, we know "he is not of the race of Solomon;" but how, with his eyes open, he could say that the Waterloo, of 80 guns, in ordinary here, was rotten, I am at a loss to know. I am an old shipwright, and, as such, can assure your readers that there is not a sounder ship in the navy, and is fit for any service in any part of the world.

The Nelson, certainly, is not in a good state: but how is this? Chiefly from winter-felled American timber being worked into her; it is this timber which is rotten, while the summer-felled English timber is good. The rotten timber is of that sort with which Mr. Burridge threatens "the annihilation of the ships of England," by its durability in American ships of war.

I am Sir,
A Superannuated Quarterman.
Portsmouth, Decr. 21, 1824.

### THE BALANCE.

Sir,—I am surprised at seeing your Correspondent "C. D." page 160 of your last number, mention, as a singular property of the Balance, that a man in one scale, counterbalanced by weight in the other, by pressing the beam upwards, will cause the scale in which he stands to preponderate. The reason of this is so clear that it would, indeed, be singular if it were otherwise. But, to produce the effect stated, the pressure must be applied between the pivot and the point of suspension. Suppose that he presses with a force of 30 pounds midway between the pivot and the point of suspension, he throws 30 lbs. additional weight on the scale, whilst his pressure upwards will produce a force of 15 lbs. only, on account of the leverage. The effect on a downward pull at the same part of the beam will be to cause the other scale to preponderate. But if the pressure could be applied beyond the point of suspension as far as

* The deteriorating effects of this system, in an architectural point of view, are well exemplified in the appearance of that otherwise noble building, Somerset House: as seen from Waterloo Bridge, its grandeur seems lost, and its beauty completely disfigured, by the numberless grotesque contrivances by which it has been fruitlessly attempted to carry off the smoke.

that point is beyond the pivot, then a power of 30 lbs will give an effect of 60 lbs.

I am, Sir,
Yours respectfully,
G. B.

Rotherhithe-Street,
Decr. 27, 1824.

---

UNEQUAL DISTRIBUTION OF HEAT IN THE PRISMATIC SPECTRUM.

That the different portions of the prismatic solar spectrum possess different heating powers, has been universally admitted by every philosopher who has examined the subject experimentally; but a great diversity of opinion has prevailed respecting the precise point where this power resides in its greatest intensity Landriani, one of the first who investigated this subject, placed the maximum heating power in the yellow rays, Rochon in the orange or orange yellow, and Senebier also in the yellow. Herschel, on the contrary, found the heating power of the red to be superior to that of all the other coloured rays; but that there is a certain point of the spectrum, situated immediately beyond the red and invisible, which elevates the thermometer still higher than any of the visible rays. His experiments were directly contradicted by Leslie, but were soon after, in a great measure, confirmed by Englefield. Dr. Seebeck, in a memoir read to the Royal Academy of Sciences in Berlin, which with numerous original experiments, combines a copious discussion of the opinions of preceding inquirers. appears to have ascertained the cause of those anomalous statements. It exists in the particular nature of the medium by which the rays of light are decomposed; a circumstance so little regarded that few experimenters have even deemed it necessary to record the material of of their prism. The following is a summary of his results.

In every part of the prismatic spectrum there is a perceptible elevation of temperature, and this is uniformly least in the outermost edge of the violet From the violet it gradually increases, as we proceed through the blue and green into the yellow and red. In some prisms it attains a maximum in the yellow, as. for example, in those filled with water, alcohol, or oil of turpentine. In others, as in those filled with a transparent solution of sal ammoniac and corrosive sublimate it attains a maximum in the orange. Prisms of crown glass and of common white glass have the maximum of temperature in the centre of the red; others, which appeared to contain lead, have the maximum in the limit of the red. Prisms of flint glass have the maximum beyond the red. In all prisms, without exception, the temperature regularly diminishes from beyond the red; but it still continues perceptible at a distance of several inches from the extremest limit of that side of the visible spectrum.—*Schweigger's Neues Journal*, vol. x. p. 129.

---

CONVERSION OF HONEY INTO SUGAR.

The Jews in Moldavia and Ukrane have a method of making honey into a hard and white sugar, which is employed by the distillers of Dantzic to make their *liqueurs*. The process consists in exposing the honey to the frost during three weeks, sheltered from the sun and snow in a vase of some material which is a bad conductor of caloric. The honey does not freeze, but becomes transparent and hard as sugar.—*Hanoverisches Magazine*.

---

TO DETERMINE SPECIFIC GRAVITIES.

If the body be a solid, fill a phial with water, and note its exact weight in grains. Take a hundred grains of the substance to be examined and drop it into the water; now weigh the phial again, and the differense between its present and former weight will give the specific gravity of the substance. If the body be a liquid, a bottle or phial, the weight of which is known, and which holds exactly five hundred or a thousand grains of water, is to be filled with the substance and weighed; the weight, deducting the weight of the bottle, will be the specific gravity of the substance. For example, if the bottle contained a thousand grains of water, is to be filled with sulphuric acid, it will be found to weigh from

16 hundred to upwards of 18 hundred grains, and the weight will be the specific gravity.

### FRAGRANT LAMPS.

MR EDITOR,—Perhaps you may thank me for the following little account of a method of preserving the air of apartments comparatively pure, and at the same time of dispersing a pleasant fragrance through them. By means of a wire fixed to one side or at the back part of the lamp, according to its nature, and bent at right angles, so as to be a few inches above the top of the flame, a piece of sponge is to be suspended. This is to be soaked in a mixture of best vinegar and water, and squeezed nearly dry before it is hung up. By this means the vinegar is constantly dispersed through the apartment, and gives a very fragrant smell. It would probably be very useful in manufactories and close workshops, and is of course as easily applicable to gas as other lights. It costs very little, for the same piece of sponge has served me a whole winter. It must be occasionally re-immersed in the water and vinegar, and then will be found to give out a great quantity of soot, which otherwise fouls the air of the apartments.

Your obedient servant,

EIN DEUTSCHER.

### DISTINCTION OF POSITIVE AND NEGATIVE ELECTRICITY.

POSITIVE and negative electricity may be readily distinguished by the taste, on making the electric current pass by means of a point on to the tongue. The taste of the positive electricity is acid; that of the negative electricity is more caustic, and, as it were, alkaline.—*Berzelius.—Journal of Science.*

### PRESERVATION OF SEEDS.

THE late M. Zea, the celebrated Peruvian botanist, asserts, that the most delicate seeds of American plants may be sent to Europe in the highest preservation, by being enveloped in that kind of raw brown sugar which always keeps its humidity. When the seeds are to be sown, it is only requisite to immerse them in lukewarm water which will take off the sugar.

### COLOURED FLAMES.

ADD a little boracic acid to a spoonful of alcohol, and stir them together in a saucer or cup, then set them on fire, and the flame will be of a beautiful green colour. If strontites in powder be added to alcohol, it burns with a carmine flame; if barytes be added, the flame is yellow; if the alcohol contain muriate of magnesia, it burns with a reddish-yellow flame.

### NEW PURPLE DYE.

M. BUSSY, has lately made some experiments on the sulphuric acid of Nordhausen, and among other results obtained the following curious one.

"Among all the properties of the fuming liquor, (the fuming sulphuric acid of Nordhausen,) it is remarkable that it dissolves indigo instantly even when cold; but this solution instead of being blue, like the ordinary solutions of indigo in sulphuric acid, is of a magnificent purple, resembling precisely the vapour of indigo. Fearing," he adds, "that this colour arose from some extraneous matters, I purified a portion of the indigo by sublimation, and the same phenomenon was renewed. This property of dissolving indigo purple, is inherent in the pure sulphuric acid, and the sulphurous acid does not at all contribute to it. When the solution is exposed to the air, the acid extracts moisture, and the solution becomes blue. The same effect takes place if common sulphuric acid be added. I consider," says M. Bussy, "that in the purple solution, the indigo is much more divided than in the blue, and that the purple colour, which is proper to it, appears for the same season as indigo; though blue, when in mass, becomes red when dissipated by heat into vapour." The fuming acid, for dissolving a much larger quantity of indigo, proportionally, than the ordinary acid, would, according to M. Bussy, be of great value in the arts, could it be cheaply manufactured.